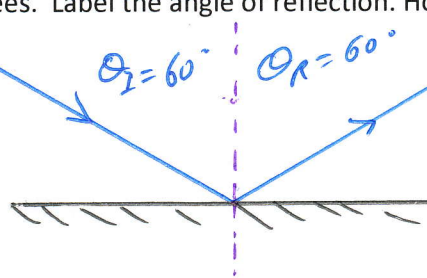


Unit III: Reflection of Light Review

Law of Reflection

- 1) Draw a diagram that shows a mirror with a normal line and a ray of light hitting the mirror at an angle of incidence of 60 degrees. Label the angle of reflection. How many degrees is this angle of reflection?

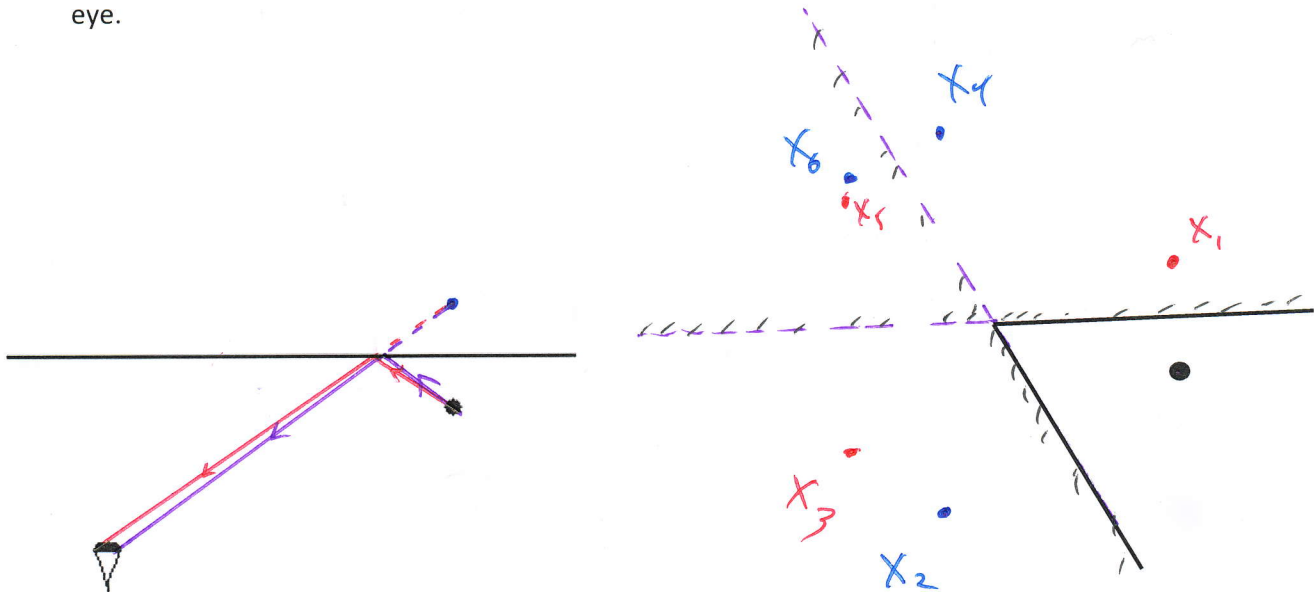


- 2) Light strikes a mirror's surface at 20 degrees to the normal. What will the angle of reflection be?

20°

Plane Mirrors

- 1) Find the image of each object. Trace the rays to show how the eye would see the object. If there is an eye.



Note: X_4 and X_5 should be in the same spot. This would give you 5 exact images.

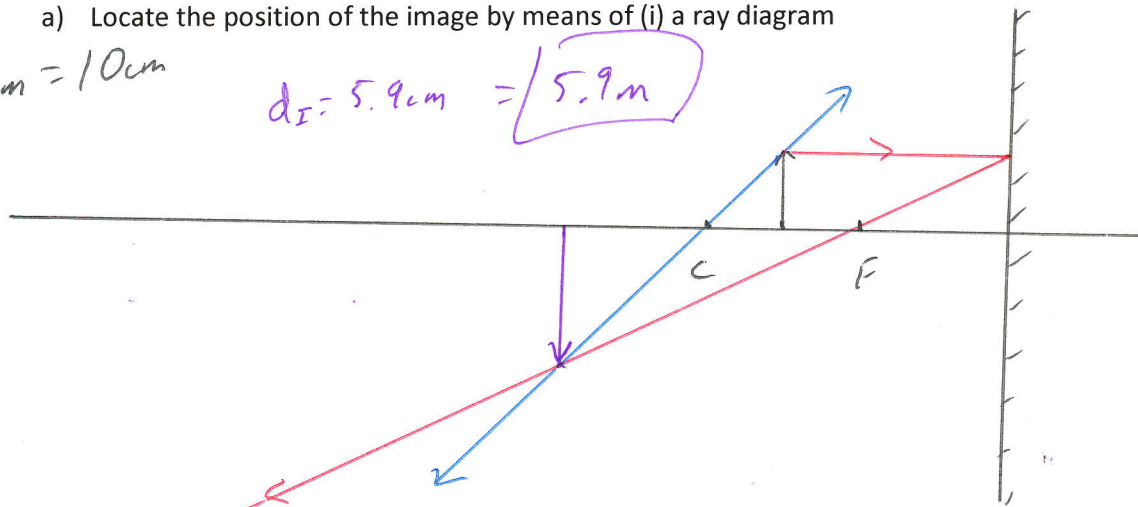
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2) A candle is placed 30 cm from the vertex of a concave mirror that has a focal length of 20 cm.

a) Locate the position of the image by means of (i) a ray diagram

$$l_{cm} = 10cm$$

$$d_i = 5.9cm = \boxed{5.9m}$$



(ii) the mirror equation. ($d_i = 60\text{ cm}$)

$$d_o = 30\text{ cm}$$

$$f = 20\text{ cm}$$

$$d_i = ?$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\frac{1}{d_i} = \frac{1}{f} - \frac{1}{d_o}$$

$$\frac{1}{d_i} = \frac{1}{20\text{ cm}} - \frac{1}{30\text{ cm}}$$

$$\left(\frac{1}{d_i}\right)^{-1} = \left(\frac{1}{60\text{ cm}}\right)^{-1}$$

$$\boxed{d_i = 60\text{ cm}}$$

b) Find the magnification of the image. ($M = -2$)

$$M = \frac{-d_i}{d_o}$$

$$M = \frac{-60\text{ cm}}{30\text{ cm}}$$

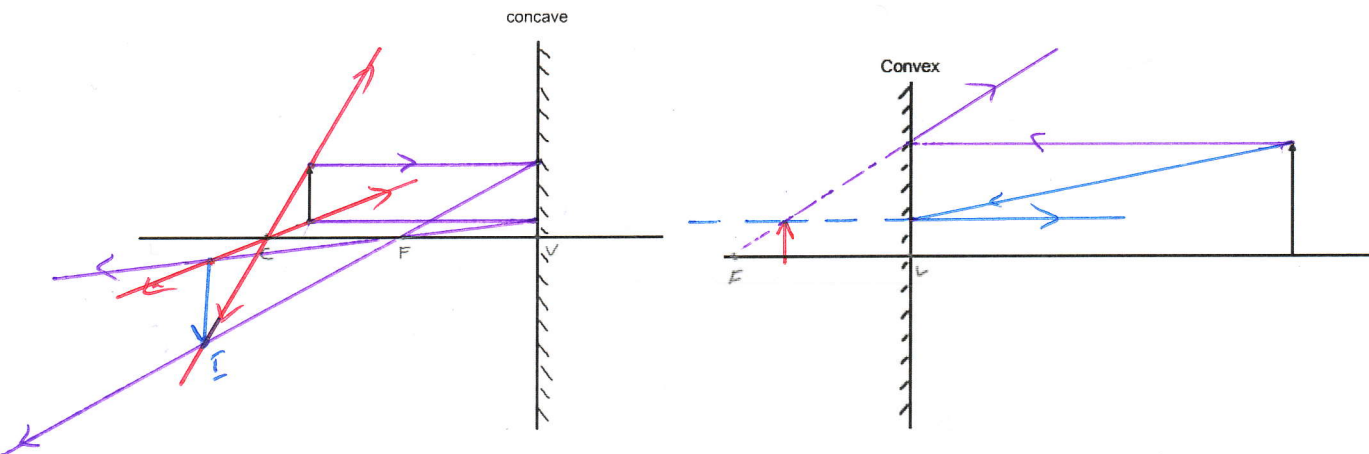
$$\boxed{M = -2}$$

c) Describe the characteristics of the image.

Real, Inverted, Beyond C, Larger

Spherical Mirrors

- 1) Draw the image.



Scale Diagrams \ Mirror Equation

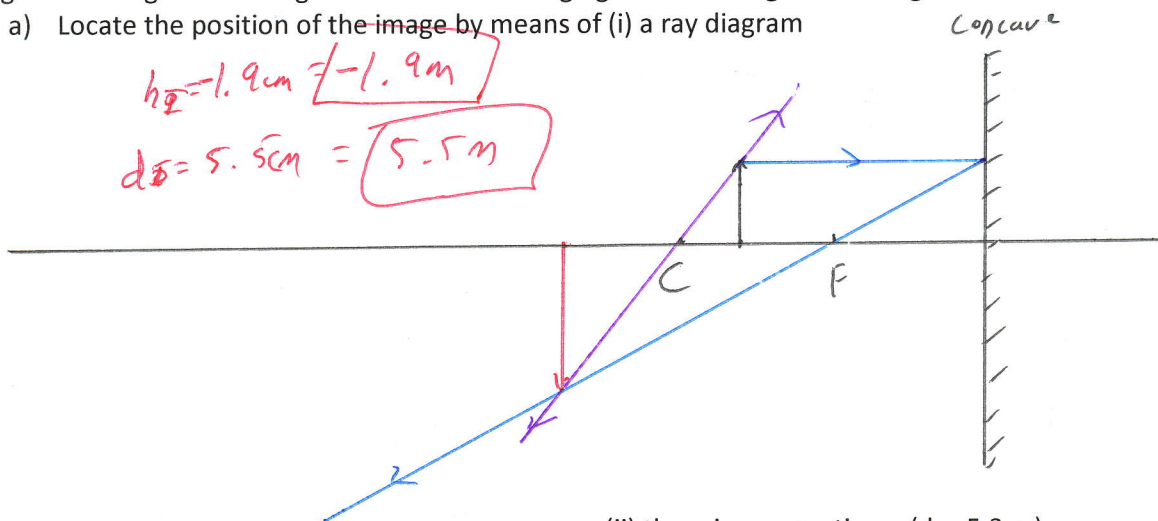
- 1) A tiger 1.1 m high is standing 3.2 m from a converging mirror having a focal length of 2.0 m.

- a) Locate the position of the image by means of (i) a ray diagram

$$1 \text{ cm} = 1 \text{ m}$$

$$h_i = -1.9 \text{ cm} = -1.9 \text{ m}$$

$$d_o = 5.5 \text{ cm} = 5.5 \text{ m}$$



- (ii) the mirror equation. ($d_i = 5.3 \text{ m}$)

$$h_o = 1.1 \text{ m}$$

$$d_o = 3.2 \text{ m}$$

$$f = 2.0 \text{ m}$$

$$d_i = ?$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$\frac{1}{f} - \frac{1}{d_o} = \frac{1}{d_i}$$

$$\frac{1}{2.0 \text{ m}} - \frac{1}{3.2 \text{ m}} = \frac{1}{d_i}$$

$$\left(\frac{3}{16 \text{ m}} \right) = \left(\frac{1}{d_i} \right)$$

$$\frac{16 \text{ m}}{3} = d_i$$

$$d_i = 5.3 \text{ m}$$

- b) Determine the height of its image. ($h_i = -1.8 \text{ m}$)

$$h_i = ?$$

$$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$$

$$h_i = \frac{-d_i h_o}{d_o}$$

$$h_i = \frac{-(5.3 \text{ m})(1.1 \text{ m})}{3.2 \text{ m}}$$

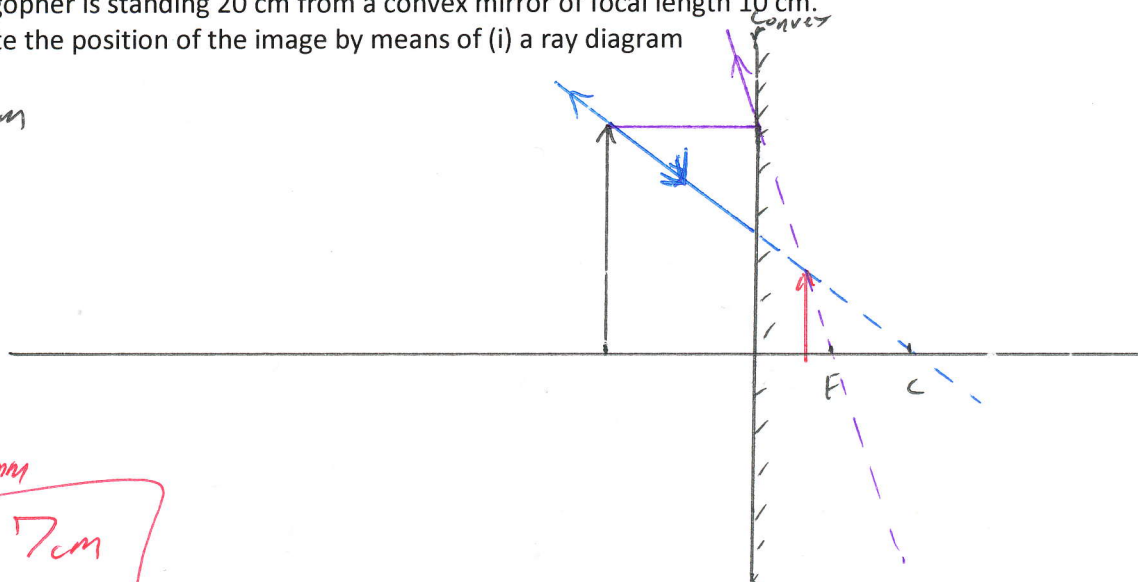
$$h_i = -1.8 \text{ m}$$

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3) A 30 cm tall gopher is standing 20 cm from a convex mirror of focal length 10 cm.

a) Locate the position of the image by means of (i) a ray diagram

$$1 \text{ cm} = 10 \text{ mm}$$



$$d_i = -0.7 \text{ mm}$$

$$d_i = -7 \text{ cm}$$

(ii) the mirror equation. ($d_i = -7 \text{ cm}$)

$$\begin{array}{l} h_o = 30 \text{ cm} \\ d_o = 20 \text{ cm} \\ f = -10 \text{ cm} \\ d_i = ? \end{array} \quad \left| \begin{array}{l} \frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \\ \frac{1}{f} - \frac{1}{d_o} = \frac{1}{d_i} \\ \frac{1}{-10 \text{ cm}} - \frac{1}{20 \text{ cm}} = \frac{1}{d_i} \end{array} \right| \quad \left| \begin{array}{l} \left(\frac{3}{20 \text{ cm}} \right) = \left(\frac{1}{d_i} \right)^{-1} \\ \frac{-20 \text{ cm}}{3} = d_i \end{array} \right| \quad \left| d_i = -7 \text{ cm} \right|$$

b) Find the magnification of the image. ($M = 0.3$)

$$M = ? \quad M = \frac{-d_i}{d_o} = \frac{-(-7 \text{ cm})}{20 \text{ cm}} = \boxed{0.35} \quad (\text{will be } 0.3 \text{ if using unrounded } d_i)$$

c) What is the height of the image? ($h_i = 10 \text{ cm}$)

$$\begin{array}{l} h_i = ? \end{array} \quad \left| \begin{array}{l} \frac{h_i}{h_o} = \frac{-d_i}{d_o} \\ h_i = \frac{-d_i h_o}{d_o} \end{array} \right| \quad \left| \begin{array}{l} h_i = \frac{-(-7 \text{ cm})(30 \text{ cm})}{20 \text{ cm}} \\ \boxed{h_i = 10 \text{ cm}} \end{array} \right|$$

d) Describe the characteristics of the image.

Virtual, Upright, Smaller, Behind mirror

Grab Bag

Describe the characteristics of an image of a person seen in a plane mirror.

Same Size, Virtual, Behind mirror, Upright

\Rightarrow Lateral Inversion

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Describe the characteristics of a virtual image in a spherical mirror.

Concave:

Behind mirror, larger, Upright

Convex:

Behind mirror, smaller, upright

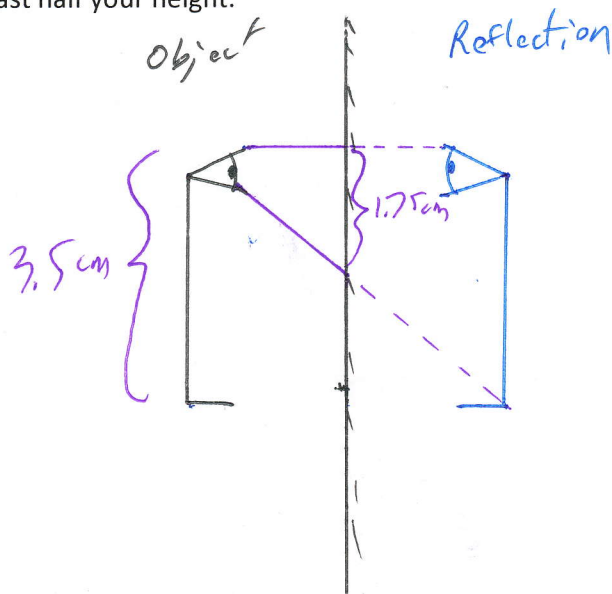
An object produces a virtual image in a concave mirror. Where is the object located?

Between F and V ; inside the focal point

An object produces no image in a concave mirror. Where is the object located?

on F ; at the focal length (f)

Draw a ray diagram of a plane mirror to show that if you want to see yourself from your feet to the top of your head, the mirror must be at least half your height.



A concave mirror has a focal length of 10 cm. What is its radius of curvature?

$$R = 2f$$

$$R = 2(10 \text{ cm})$$

$$R = 20 \text{ cm}$$